Reviews and Abstracts: Vol. 1, No. 3

ADMINISTRATION AND OPERATION OF COMPUTER CENTERS

58:

Abbott, Charles G. **Buy, lease, share a computer—or utilize a service bureau.** *Computers and Automation*, **9,** 2 & 2B (February 1960), 15–18.

The author contrasts the characteristics of the problems which are placed on off-premise and on-premise computers. Service bureau usage and shared EDP facilities are compared with respect to type of problems and the financial aspects associated with the two alternatives. Ingredients of a cooperative program are spelled out.

After rationalizing the illusory nature of technical obsolescence, the author compares the financial aspects of renting *versus* buying a machine, resolving the problem in favor of purchase. Consideration is given to interest, depreciation, insurance, maintenance, and federal taxes.

The article will provide material for thought by management facing the problem posed in the title. Ready-made answers are not provided.

Jack Moshman, Arlington, Va.

ANALOG COMPUTER TECHNIQUES

59:

Prudkovskiy, G. P. **Primeneniye elektroliticheskoy vanny v kachestve vychislitel'nogo ustroystva** (An electrolytic tank as a computer). *Pribory i Tekhnika Eksperimenta* **3** (1959), 77–79. (Russian)

The instrument seeks out and delineates the equipotential lines in the tank. The instrument resembles that described by Holloway (*Proc. Inst. Elec. Eng* **103B,** Nr 8, 1956). An a-c potential is applied to the tank and to a voltage divider (Fig. 1); the output contains α phase-sensitive detector, which receives the amplified signal from the probe and causes the printing head to operate every time the probe passes through the equipotential line defined by the voltage divider. The probe is moved by hand. Fig. 2 gives a general impression of the instrument: Fig. 3 shows the results for a tank designed to reproduce a complex function tabulated in Yanke and Emde, while Fig. 4 shows exp x cos y. The paper ends with a brief note on the use of the tank for reproducing such functions in voltage form. There are 5 figures and 8 references, 7 of which are Soviet and 1 English.

(*Translated from the Abstract*)

60:

Vasil'yev, Vyacheslav Georgiyevich. **Avtomaticheskoye ustroystvo dlya resheniya integral'nykh uravneniy Vol'terra vtorogo roda s yadrom tipa k(t−x)** (Automatic equipment for the solution of Volterra integral equations of the second kind with a kernel of the $k(t-x)$-type). *Nauchnyye Doklady Vysshey Shkoly. Elektromekhanika i Avtomatika* **4** (1958), 36–38. (Russian)

Usually computers with nonlinear direct-current models are used for the solution of Volterra integral equations. In these devices the Volterra integral equations are solved by means of the method of the successive approximation. But these equations can also be solved by means of computers with linear direct-current amplifiers. These devices give the solution in a single working operation. Here a block circuit of such a device for the solution of Volterra integral equations of the second kind with a kernel of the $k(t-x)$-type is given. It is shown that on the basis of this circuit an automatic device can be realized, securing the solution of Volterra integral equations of the second kind with the required exactness on finding the searched function. In the circuit given here there are three linear inertialess direct-current amplifiers and a passive quadrupole. Instead of two of the linear direct-current amplifiers, there can also be used systems with an amplitude modulator, an alternating-current amplifier, and a phase sensitive detector in the automatic devices given here. The publication of this paper was recommended by the Kafedra avtomatiki, telemekhaniki i matematicheskikh mashin Moskovskogo energeticheskogo instituta (Chair of Automation, Telemechanics and Mathematical Machines at the Moscow Institute of Power Engineering). There is 1 figure.

(*Translated from the Abstract*)

61:

Loskutov, V. I. **The electro-mechanical machine "Integral 1" for the integration of ordinary differential equations.** *Priborostroyeniye* **9** (1959), 1–6. (Russian)

First an introductory on the historial development of the above type of machines, especially in tsarist Russia, is given. Thus, in 1911, the first differential analyzer for the integration of ordinary differential equations up to the fourth order inclusive was constructed in Petersburg in the mechanical workshop of Vettser. In 1939 a mechanical differential analyser with 6 integrators was constructed under the direction of I. S. Bruk, Corresponding Member of the AN USSR, in the USSR. The most efficient machine

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of this kind is "Integral 1" which was developed and constructed in the Soviet Union and is at present in permanent use at the Kiyevskiy Gosudarstvennyy Universitet im. T. G. Shevchenko (Kiev State University imeni T. G. Shevchenko). This unique machine was developed under the supervision of A. A. Bednyakov, Engineer. "Integral 1" contains 24 integrators and is adapted for the mechanized solution of systems of ordinary differential equations with given initial conditions (as are found in the automatic control of production processes and in other branches of science and engineering). The precision attained with this machine equals that of the numeric integration using four-figure numbers. The parts of the "Integral 1" are listed. The structural scheme of the machine consists of 4 sectors which are controlled by a main switching board. Approximately 1 hour is required for the solution of one problem. Results of the solutions are ejected either as a table of the required functions, or in graphical form. The minimum space required for the assembly of the machine is 250 m^2. Without wiring and feeding devices the machine has a total weight of 25 t. The power consumption is 100 kw. Each variable of the equation to be solved is represented in the appropriate scale by the angular displacement of a certain shaft. The differential analyser can be adapted to solve one or the other system of differential equations by suitable combinations of mathematical devices contained in the machine. The functions appearing in the equations may be given graphically or be determined by integration of auxiliary differential equations. By means of an integrator of the type described here, integration may be carried out with respect to any variable, which increases the mathematical possibilities of this machine considerably. In the differential-integrator described here the functions are integrated by means of a friction mechanism (integrator). Special blocks and devices are used for the introduction of the necessary constants into the differential equation and for the performance of algebraic operations involving variable quantities. Reducers are used for the multiplication of quantities with constant coefficients, and also for other operations. The individual parts of the machine are then discussed. Solutions of the problems solved by means of the differential analyser may be determined in graphical form or in the usual numerical manner. The machine described here does not replace the universal electronic machines, but complements the computers available at present. There are 7 figures and 1 table. (*Translated from the Abstract*)

62:

Baranchuk, Ye. I. **On the theory of electromechanical differential analyzers.** *Isvestiya Vysshikh Uchebnykh Zavedeniy, Priborostroyeniye* 4 (1958), 76–86. (Russian)

The author considers in this paper simplified analysis methods of the dynamic accuracy and stability of electromechanical analyzers, solving systems of differential equations with nonrandom functions, in noncritical cases in the sense of A. M. Lyapunov. The application of servomechanisms as moment amplifiers and also small (parasite) parameters of the other amplifiers lead to higher orders of analyzer equations, compared to the equations to be solved and to dynamic errors, as well as possible instability. This problem originated from their application in analog computers in connection with the creation of the electronic integrators of L. I. Gutenmakher and was considered in a number of papers of I. S. Gradshteyn [Ref. 8]. In this paper, the problem is solved on the basis of constructional features of electromechanical analyzers by means of frequency methods. The canonical transformation used in this paper permits the determination of the influence of the deviation of any parameter on the errors of differential analyzers without any special difficulties. Finally, the author states that the methods explained in this paper may be effectively used for the analysis and the design of electronic differential analyzers. There are 5 diagrams and 11 references, 3 of which are English and 8 Soviet. (*Translated from the Abstract*)

APPLICATIONS TO LINEAR AND DYNAMIC PROGRAMMING

63:

Galer, G. S. **The use of computers for economic planning in the petroleum chemical industry.** *The Computer Journal*, **2,** 3 (October 1959), 145–149.

This short, but very worthwhile, paper discusses the use of linear programming techniques by the Royal Dutch/Shell Group. The author reviews the formulation and results of a particular manufacturing and marketing model. Royal Dutch's experience is typical in that the development of the model began in 1955 and it has since passed through an evolutionary process to emerge as a model which is regularly used for the formation of optimum plans.

Although the "modelers" recognized the existence of certain non-linearities in the physical situation, they were able to demonstrate that within *the region of normal operation,* the objective function and constraints can be closely approximated by linear expressions. A small scale interpretation of a three product model is given by the following problem:

Maximize

$$C_1X_1 + C_2X_2 + C_3X_3 - C_4X_4$$

subject to:

$$\left.\begin{aligned} X_1 &\leqq S_1 \\ X_2 &\leqq S_2 \\ X_3 &\leqq S_3 \end{aligned}\right\} \text{Sales}$$

$$\left.\begin{aligned} X_1 \qquad\qquad\qquad\quad - pX_4 &\leqq 0 \\ X_2 + h/(h+k)X_3 - qX_4 &\leqq 0 \\ K/(h+k)X_3 - rX_4 &\leqq 0 \end{aligned}\right\} \text{Conversion}$$

$$X_4 \leqq C \qquad \text{Capacity}$$

The meaning of the sales and capacity inequalities is apparent. The conversion inequalities state that sales and usage of a product cannot exceed the amount made (where p, q, r represent the yields of the three products per unit of input resource X_4). The second and third products must be blended in the ratio $h:k$.

The actual model consisted of 90 sales equations, 45 conversion equations and 15 to 20 capacity equations. Further refinements of the operational model are reviewed. Most of the actual computations were done on the Ferranti Mark I* computer.

The author notes that at present the model is used in three ways: (1) To produce truly optimum plans that have been used chiefly to set up annual budgets; (2) To produce the regular operating programs which, due to commercial reasons, use stronger constraints and hence differ from the true optimum; (3) As a tool to study the effects of changes in the constraints and objective function, and general economic analysis.

The Group is now turning its attention to long-term investigations and is now faced with large programs which arise when one attempts to optimize over-time. The author states that such a program will have up to a 1,000 equations which can be solved on the new Ferranti Mercury. This will certainly be a major accomplishment!

Saul I. Gass, Washington, D. C.

64:

Liebel, Eberhard; and Zeyen, Günter. **Flood'sches Berechnungsverfahren fur die optimal Zuordnung von Maschinen zu Betriebspunkten** (Flood's computational procedure for the optimal assignment of machines to working stations). *Elektronische Datenverarbeitung*, **3** (1959), 7–14. (German)

A partial flow diagram is given for Flood's algorithm for the optimum assignment problem. It is reported that a code for the ZUSE Z22 computer, based on this algorithm, has been used successfully. Small numerical examples, representing an application in the coal industry, are used to illustrate the algorithm. The flow diagram does not show how the code selects the set of lines of the matrix that includes all the null-elements, which is the critical step in the algorithm, nor is the code written to apply also to the transportation problem. Running times are not given except for 22 seconds on a 6×6 example, but use of the code is said to yield savings in present applications to the West German coal industry.

Merrill M. Flood, Ann Arbor, Mich.

65:

Hoffman, Walter; and Pavley, Richard. **A method for the solution of the N-th best path problem.** *J. Assoc. Comput. Mach*, **6,** 4 (October 1959), 506–514.

A network is defined as a directed graph with each edge of which is associated a positive real number called a value. The value of a path is taken to be the sum of the values of all the edges traversed by the path. In a suggested application the graph is composed of highways, and the value of a path is the length of time required to drive an automobile along the path. Given any pair of points, there is an algorithm due to Dantzig [*Operations Res.* **5,** (1957), 270–273] and the reviewer [*Annals of the Computation Laboratory of Harvard University*, **30** (1957), 285–292] for finding the path between them whose value is the minimum. Given any integer N, this paper gives an extension of the algorithm which permits rapidly finding a set of N different paths having values as small as possible. This extended algorithm is suited to machine computation, in that it requires only an amount of memory sufficient to store a description of the network and of N paths. Under reasonable assumptions on the shape and planarity of the network, estimates are made of how the computing speed varies with N and with the number of vertices of the network.

Edward F. Moore, Murray Hill, N. J.

(Courtesy, *Mathematical Reviews*)

BUSINESS DATA PROCESSING

66:

Schuff, H. K. **Entwicklungstendenzen im Bereich der elektronischen rechenanlagen** (Developmental tendencies in the region of electronic computing machines). *Elektronische Datenverarbeitung*, **1** (1950), 1–9. (German)

It is the contention of the author that at the time this article was written (before 1959), the use of electronic computers in business data processing was hardly justified economically, even in the U. S. In Europe, the situation was even worse, since the foreign exchange favored the hard dollar, so that wages (in comparison) were ¾ times lower. He contrasts the cheap solution of scientific problems with the facts that computers in the commercial field were not always successful and that not even medium-sized computers were fast enough to cope with card or tape input, to say nothing of programming difficulties with problems of industrial planning, etc.

Schuff is of the opinion that American large-scale computers are too expensive for Europe. He outlines some of the latest computers used there, which made it economically feasible to replace punched card systems at a significant decrease in elapsed time.

ZUSE Z 22, a medium-sized, 1-address vacuum tube computer, with an 8 K drum (price $50,000). Of interest is its order structure, in which each of the 18 bits executes a specific micro-order, thus allowing each instruction to be microprogrammed.

SIEMENS 2002, a transistorized, decimal machine with core storage, drum, internally checked input and output (punched tape, typewriter, IBM tabulator, 727 magn. tape, and card input from an IBM collator); 3000 instructions/sec., 12 dec. digits + sign. Two index registers and a special substitution register allow interesting address modifications ($400,000).

STANDARD ELEKTRIK ER 56, a transistorized, decimal, self-checking computer with core storage and a full complement

of external storages and input/output units (including a 900 line/min. printer). Its normal word-length of 7 digits can be automatically doubled, even for floating point. A special feature is an electronic exchange, allowing simultaneous assignment of any core block to any unit (arithmetic, control, external storage, input/output) (price $250,000).

For DP problems, a special *Informatiksystem* computer is available with all the advantages and drawbacks of wired-in programs. The possibility of keyed-in information allows its use for air and train reservation systems.

ELECTROLOGICA X 1, a Dutch-built, transistorized, 100 microsecond instruction computer with all types of fully buffered input and output, up to 32 K core storage. Special programs, like I/0 routines, can be wired in. Each instruction can be modified in three different ways (price $125,000—250,000).

Gerhard Reitz, Canoga Park, Calif.

67:

Goldsmith, J. A. **The state of the art—(a) commercial computers in Britain, June 1959.** *The Computer Journal*, **2,** 3 (October 1959), 97–99.

In this paper the author gives a few statistics concerned with the number of commercial computers on order and in operation in Great Britain as of June 1959. He points out the interesting fact that the number of machines on order did not increase appreciably from June 1958 to June 1959, while there were almost as many machines delivered in that period as had been installed in the previous four-year period.

The author also discusses briefly the kinds of work now being done by commercial computers in Great Britain as well as some of the difficulties that have been encountered.

Roy F. Reeves, Columbus, Ohio

68:

• Ginder, Charles E. **Why automation?** National Office Management Association, Willow Grove, Pa., 1959. 8 pp. + bibliog. $5.00.

This article presents the results of a survey on office automation, defined as the handling of data in mechanical forms that can be perpetuated by machines to further mechanical forms. The installations are grouped into electronic data processing and integrated data processing (presumably punched card and punched paper tape without electronic calculators), each of which is subdivided into small, medium, and large. Three hundred and eighty-six businesses, divided into 24 classes, replied; but there is no indication as to how many companies failed to reply to the questionnaire altogether, or as to what extent the replies may be considered as representative of business in general. Information on the size of the installations, the size of the office staffs in the different businesses, and the types of applications (present and planned) are given in tabular form. Answers to general questions on the effects and future of office automation are summarized. A bibliography of selected articles and books which have appeared between July 1954 and August 1959 is included, along with an index of publishers.

C. C. Gotlieb, Toronto, Ont., Canada

69:

Miller, Russell. **Mobility for merchandise.** *Systems*, **24,** 1 (January–February 1960), 8–9.

The application of a Univac File Computer to the control of a wholesaler's inventory is described. To overcome a serious out-of-stock situation existing under the previous inadequate tub file system, the computer prepares weekly analytical reports which give balance on hand, previous week's sales, total sales for past four weeks, number of times item out of stock, receivings for previous week, quantity on order, etc. for each item. A study is now under way to put control on an exception basis.

Current variable information is stored on magnetic drums and historical and master file data on tapes. Other reports prepared include a daily listing of dollar sales by salesman or territory, a daily out listing, and customers' statements giving in detail all their purchases during the preceding quarter.

Despite a 30 per cent increase in the number of items handled, the man hours have been reduced 40 per cent and the out-of-stock situation cut 66⅔ per cent.

Carl H. Pollmar, Ann Arbor, Mich.

70:

Management and business automation. Keller, Arnold E., Editor. **3,** 2 (February 1960), 50 pp.

This issue contains four articles on specific applications of computers and tabulating equipment to data processing problems. (1) The transfer of Niagara Mohawk Power Corporation's billing procedure to an RCA 501 computer. This description includes a flow diagram of the planned operation. (2) The L. B. Foster Company's utilization of tabulating equipment to improve their sales and market analysis. (3) Tennessee Products and Chemical Corporation's improved ordering, billing, sales analysis procedures as a result of improved forms and the automatic production of paper tape and card records from the source documents. (4) The use of a RAMAC in recording the results of recent Winter Olympics at Squaw Valley. The U. S. is the undisputed winner of the "automation event."

An article, *A New Role for the Systems Man*, by John Haslett, describes the changing function of the systems specialist in business today with some specific examples drawn from his own Shell Oil Co. The point is made that the systems man's responsibility has increased as his job has evolved from analyzing present local procedures to synthesizing new company-wide procedures.

Interest in the role of the systems specialist is also evident in the *Letters* section of this issue, where readers have produced a vehement rebuttal to an earlier letter which apparently took a derogatory view of the systems profession.

The journal has also a useful *Product Review* section where short descriptions of new products are presented.

Bruce W. Arden, Ann Arbor, Mich.

DIGITAL COMPUTER COMPONENTS

71:

Danil'chenko, I. A. **A random number pick-up for computing machines.** *Byulleten' Izobreteniy* **8** (1959), 45–46. (Russian)

The pick-up contains a counter of the noises of thyratrons serving as a source of random numbers; to increase the operational speed and obtain equal probability for a binary random number in each column synchronously with the operation of the computing machine, the pick-up has a binary counter which alternately reads off information from counters switched in parallel with shapers and output registers where the random n-column numbers are shaped and read out.

(*Translated from the Abstract*)

72:

Polyakov, N. P. **Metodicheskiye pogreshnosti tsifrovykh fazometrov s postoyannym izmeritel'nym vremenem** (The systematic errors of digital phase meters with constant sampling times). *Pribory i Tekhnika Eksperimenta* **3** (1959), 80–83. (Russian)

The digital phase meter measures the difference between the times at which the two voltage waveforms pass through zero as the number of pulses transmitted by a gate during that time (Fig. 1 illustrates the process). Fig. 2 shows the block diagram, in which the units (reading from left to right and from top to bottom) are: two-channel amplifier and limiter, coincidence circuit No. 1, h. f. generator, frequency divider, electronic register (with usual accessories), coincidence circuit No. 2, and trigger. In the mathematical treatment, which is routine, θ is the time taken for one measurement, $\phi_{\max}$ is the maximum phase difference to be measured (2π for half-wave meters, π for full-wave meters) and m and α are respectively the integer and fractional parts of $2\pi\theta f/\phi_{\max}$. Matters such as differences in wave shape are not treated in detail, or at all. There are 4 figures and 2 Soviet references.

(*Translated from the Abstract*)

73:

Kalyayev, A. V.; Panov, D. N.; and Sukhomlinov, M. M. **A converter of continuous electrical quantities into a digital form.** *Izvestiya Vysshikh Uchebnykh Zavedeniy, Elektromekhanika* **6** (1959), 25–33. (Russian)

The authors describe an analogue-to-digital converter of their own design. The converter is based on the transformation of continuous function $y(t)$ into a sequence of pulses having a frequency f such that f is proportional to $y(t)$. It is possible to design digital integrators and differentiators by employing the same principle. The basic converter, whose output is given in the form of a discrete binary code, is illustrated by the block schematic of Figure 5. This consists of a detector D which converts the input function $y(t)$ into its modulus $|y(t)|$, a converter of the modulus $|y(t)|$ into a train of pulses P, a reversible counter RC, a pulse generator GI, an electronic switch ER and a delay circuit LZ. The functioning of the device is as follows. The converter of $y(t)$ into a train of pulses can be only operated with positive voltages. Consequently, it is necessary to form the modulus $|y(t)|$. This is accomplished in the detector. The modulus is now converted into a train of pulses which is applied to the reversible counter RC. Since the counter should add the pulses corresponding to the positive values $y(t)$ and subtract the pulses corresponding to the negative values of $y(t)$, the counter is controlled by an electronic switch. This applies an "adding" signal during tne positive values of $y(t)$ and a subtraction signal during the negative values of $y(t)$. The pulses are added (or subtracted) during a fixed interval Δt. This is done by controlling the operation of a counter by means of the timer-generator GI. The timer periodically "discharges" the counter and transfers the number of pulses recorded in the counter into a memory device. After the transfer of the information into memory, the counter is re-set by the timer through the delay circuit. The system of Figure 5 can be employed to carry out a functional transformation of $y(t)$ if a "functional transformer" is inserted at the input of the system. It is possible, however, to achieve the transformation if the frequency of the output pulses is made functionally dependent on $y(t)$, i.e. $f = F(y)$. An integrating circuit can easily be constructed. For this purpose, it is necessary to interrupt the line of the delay circuit in Figure 4. In this case, the reversible counter will continuously add on the pulses obtained from the output of the pulse converter. This process is equivalent to an approximate integration. The system of Figure 5 can also be employed as a differentiator. For this purpose, it is necessary to add a flip-flop circuit and two switches K, which operate in accordance with the logic sequence indicated in the table in Figure 6. The most important element of the converter of Figure 5 is the $y(t)$-to-f transformer. This can take the form of the circuit described by V. I. Ryzhov (Ref. 1). It is possible, however, to devise more satisfactory transformers by employing an inductively coupled multivibrator (Refs. 3–4). A multivibrator of this type, based on two vacuum tubes, is shown in Figure 8. Another satisfactory transformer circuit, based on two transistors, is indicated in Figure 9; the relationship between the input voltage (to be converted into digits) and the frequency of the output pulses is linear over a wide range of voltages, as can be seen from the graph in Figure 9.

There are 9 figures and 4 references, of which 3 are Soviet and 1 English.

(*Translated from the Abstract*)

DIGITAL COMPUTER PROGRAMMING

74:

Erdwinn, J. D.; Dahm, D. M.; and Logemann, G. W. **On the application of self-organizing storage tech-**

niques to automatic programming. *One-Day Technical Symposium*, Los Angeles Chapter, Assoc. Comput. Mach., Pasadena, Calif. (September 23, 1959), 8.

75:

• Jeenel, Joachim. **Programming for digital computers.** McGraw-Hill Book Co., Inc., New York, 1959. 517 pp. $12.00.

Math. Comput. **14** (April, 1960), Rev. 41.

76:

• McCracken, Daniel D.; Weiss, Harold; and Lee, Tsai-Hwa. **Programming business computers.** John Wiley & Sons, Inc., New York, 1959. 510 pp. $10.25.

Math. Comput. **14** (January 1960), Rev. 22.

DIGITAL COMPUTER SYSTEMS

77:

Gorelkov, L. A.; and Sotskiy, N. M. **A device for computing a correlation function.** *Byulleten' Izobreteniy*, **8** (1959), 45. (Russian)

The device is for computing a correlation function whose separate values are coded on perforated tapes and fed into the device by transmitters; to automatically compute the correlation function, calibrated resistances are connected to the outputs of the transmitters. These calibrated resistances convert the separate values of the function into amplitudes of pulses of electric voltage which are fed to an integrating d/c amplifier and added together, thus creating at the output of the amplifier a voltage which is fed to a divider; the latter gives the value of the correlation function at the output.

(*Translated from the Abstract*)

78:

Dept. of the Army. **Catalog of commercially available automatic data processing systems.** Department of the Army Pamphlet No. 1-250-4, 1958. 107 pp.

Math. Comput. **14** (January 1960), Rev. 27.

79:

Magnetic tape added to solid-state line. *Univac Review*, **2,** 3 (Fall 1959).

This article contains a reasonably complete description of the UNIVAC Solid-State 80-90 System and the magnetic tape input-output that has now been fully integrated into this system. The Solid-State System now consists of the Central Processor, 450-cards-per-minute High-Speed Card Reader, 150-cards-per-minute High-Speed Printer, and a buffered magnetic tape system which can incorporate up to ten Uniservo II magnetic tape units. The Central Processor has a 5,000-word drum memory, uses 1½-address logic, incorporates three index registers, and has all input-output units buffered for maximum efficiceny.

James W. Hanson, Chapel Hill, N. C.

80:

Schuff, H. K. **Bericht uber die Deutsche Industriemesse Hannover, 1959** (Report on the German Industrial Fair at Hannover, 1959). *Elektronische Datenverarbeitung,* **3** (1959), 36–45. (German)

Short descriptions are given of digital and analog computers, and punched tape and punched card equipment exhibited at the fair.

Digital computers: IBM 628 calculating punch, IBM 610, IBM 632 electronic booking machine; Remington Rand UCT (Univac Calculating Tabulator); ICT (A merger of Powers-Samas and British Tabulating Co.) magnetic drum calculator HEC 1201; Siemens 2002 and ER 56; Zebra; National-Elliot 802; Siemag Dataquick.

Analog machines: Donner 3100; Telefunken RA 463/2.

Punched tape, punched band (wide tape) and punched card machines: Bull, Friden, IBM, Kienzle, Lorenz, National, Remington Rand, Siemens, Anker, Burroughs, Rhienmetall (East Germany), Siemag, Torpedo, Underwood.

Illustrated.

T. W. Hildebrandt, Columbus, Ohio

81:

Kirchmann, Georg. **Die National-Elliot 405 und ihre Programmierung** (The National-Elliot 405 and its programming). *Elektronische Datenverarbeitung,* **3** (1959), 21–29. (German)

This paper gives full details in German of the National-Elliott 405 computer, its logical design, 16,384-word magnetic disc store, magnetic film backing store, control desk and order code.

The 405 computer is manufactured by Elliott Brothers (London) Limited, Boreham Wood, Hertfordshire, and is marketed in Europe by the National Cash Register Company Limited. English-speaking readers requiring further details of this machine should refer to their local offices of N.C.R., as the information given in the paper is available in English in the literature and programming manuals issued by National-Elliott.

H. W. Gearing, London, England

82:

Kurschilgen, Horst. **Die elektronische Datenverarbeitungsanlage GAMMA 60** (The GAMMA 60 electronic data processing system). *Elektronische Datenverarbeitung,* **3** (1959), 1–7. (German)

The GAMMA 60 is a high-speed electronic digital computer especially well adapted to data processing. A description is provided of the organization of the computer.

The machine consists of a central unit to which are connected independent processing, input, output, and storage elements. The central unit consists of a high-speed magnetic core memory, a transfer distributor which handles requests for data transfers applying preset priorities to simultaneous requests, and a program distributor to

handle requests for instructions. The processing elements include an arithmetic unit, a logical unit, a comparison unit allowing two-way and three-way comparisons, and a translator for transforming input-output codes. The organization of the GAMMA 60 permits the simultaneous operation of the input, output elements. Magnetic drums and tapes are available to allow the machine to process large volumes of data more efficiently.

J. D. Porter, Lexington, Mass.

83:

Smol'nikov, L. P. **On the use of computing devices for the automatic control of the rolling speed of a reversing mill.** *Elektrichestvo*, **9** (1959), 9–13. (Russian)

Some problems connected with the use of computing devices for the control of the rolling-speed of a reversing mill are examined here. The exact analysis shows that the motor-speed curve, at which the maximum output of the rolling mill, at a complete utilization of the electric drive, is guaranteed, is characterized during the operation period by maximum permissible accelerations and retardations. The maximum acceleration to the operational speed is determined by the overload-capacity of the motor, and alters therefore with the variation of load and speed. The maximum admissible retardation during braking of whatever speeds, can be assumed to be constant. The reversal of the drive during the interval must take place with constant retardation (and acceleration respectively): Equation (1). For the realization of the predetermined speed-curve, the control-system of the main-drive must guarantee the acceleration of the drive with the raw ingot in the form of a function of the current, and the retardation with the raw ingot and the reversal during the interval in the form of a function of the acceleration (Fig. 1). The speed-curve is finally determined for each pass after the selection of the gripping-speed y_1 and the ejection-speed y_2. The problem of rationally selecting the gripping- and ejection-speed is examined here more thoroughly than in other papers (Refs 4, 5). It is shown that it is suitable to keep y_1 as high as possible. The maximum value of y_1, however, is restricted. y_1 must be chosen for each pass, starting from the condition for a reliable gripping of the raw ingot, in accordance with the equation (5), for example. y_2 must be chosen as small as possible. The minimum duration of the interval is at the same time limited by the equation (9). The coefficient ρ for the sliding friction of the metal on the roller-bed influences the ejection-speed considerably. The influence of the metal temperature, the length of the material to be rolled, the scale, etc., on ρ is known too little, and it is recommended to carry out investigations in this respect. The automatic control of the roller-speed is then examined. A diagram of such a control, using a computer-installation, is shown in figure 3. It determines the direction of rotation of the drive-motor of the rolling mill, gives the commands for the decrease of the gripping-speed during slipping-through, and for the acceleration of the drive to operating-speed, chooses the necessary gripping- and ejecting-speeds, as well as the acceleration during the interval, and realizes them. All these operations show a logical character, and are carried out after obtaining information from the instruments, which indicate the presence of the raw ingot between the rollers, and its position. The optimum speeds during gripping and ejecting must be computed in advance, or be determined experimentally. They are then fed into the automatic installation in the form of a certain program, a perforated card, for example. The operations, which the automatic installation has to carry out for the realization of the predetermined ejection-speed, are examined here. Digital computers with semiconductor or ferrite elements are recommended as the most suitable and most promising computing devices. There are 4 figures and 6 references, 4 of which are Soviet.

(*Translated from the Abstract*)

84:

van Praag, V. A. **Problems of communication with a digital computer.** *One-Day Technical Symposium*, Los Angeles Chapter, Assoc. Comput. Mach., Pasadena, Calif. (September 23, 1959), 11–19.

EDUCATION AND COMPUTERS

85:

• Ivall, T. E. **Electronic computers, principles and applications.** 2nd Edition, Philosophical Library, N. Y. (1960). 8 + 259 pp. $15.00.

"This book is an introduction for those who are beginning to take an interest in electronic computers. It is not, therefore, a book for computer experts. Nor is it a textbook. What the book *does* try to do is to give a reasonably broad picture of electronic computing to those who are likely to become involved in some specialized aspect of it, either as users or as electronic designers in the immediate future."

The author puts more stress on the hardware and special uses than he does on programming. Since he has long been an editor of *Wireless World*, he knows what he is writing about and is also able to write clearly. Thus, for what it attempts to do, the book is very successful and is also surprisingly up to date in the hardware (both in current use and in research). There is an emphasis on English computers, which shows that English and American practice are not very different.

R. W. Hamming, Murray Hill, N. J.

86:

Goldsmith, J. A. **The state of the art—(b) computers in British universities.** *The Computer Journal*, **2,** 3 (October 1959), 100–102.

In this paper the author points out that until sometime around 1957 there were only three general purpose digital

computers in British Universities, but that since that time a number have been installed. Associated with almost all of these has been a training program in their use. They are generally used in Great Britain as in the U. S. for training and research, though some commercial work has usually been done.

The author discusses to some length the difficulties connected with financing large-scale fast machines in a university and indicates in part how these difficulties may be overcome.

Roy F. Reeves, Columbus, Ohio

87:

• Alt, Franz L. **Electronic digital computers.** Academic Press, New York, 1958. 326 pp. $10.00.

Math. Comput. **14** (January 1960), Rev. 25.

88:

• Jacquette, William J.; Ginder, Charles E.; and Baker, Harry L., III. **NOMA glossary of automation terms.** National Office Management Association, Willow Grove, Pa., April 1959. 35 pp. $2.00.

In the foreword to this glossary "special acknowledgment" is given to the staff of the Ballastic Research Laboratories, Aberdeen Proving Ground, Md. for permission to reprint from the glossary which appeared in its publication: *A Second Survey of Domestic Electronic Digital Computing Systems.* (See also *Comm. of A.C.M.* **1,** 6; **1,** 8; **1,** 9; **1,** 10; **1,** 11.)

The present publication contains all the terms of the above glossary without additions or deletions. Under the circumstances, the title, *NOMA Glossary of Automation Terms*, is less than fair.

The glossary itself contains a rather high proportion of terms which are of engineering significance, many of them used in their normal sense, e.g. tetrode; ultrasonic; tube, acorn; multivibrator. Nevertheless, the 466 terms in it are carefully defined, and for some time it has been the best glossary available for computing terms.

C. C. Gotlieb, Toronto, Ont., Canada

INFORMATION STORAGE AND RETRIEVAL

89:

Bratman, H. **Clip—a compiler and language for information processing.** *One-Day Technical Symposium*, Los Angeles Chapter, Assoc. Comput. Mach., Pasadena, Calif. (September 23, 1959), 3–4.

90:

Hornick, S. D. **IBM 709 tape matrix compiler.** *One-Day Technical Symposium*, Los Angeles Chapter, Assoc. Comput. Mach., Pasadena, Calif. (September 23 1959), 5–7.

91:

Schroeder, S. C. **Continuous telemetry data processing.** *One-Day Technical Symposium*, Los Angeles Chapter, Assoc. Comput. Mach., Pasadena, Calif. (September 23, 1959), 9–10.

92:

Schuff, H. K. **Magnetkarten als Informationsträger in Datenverarbeitungssystemen** (Magnacards as information carriers in data processing systems). *Elektronische Datenverarbeitung*, **4** (1959), 26–31. (German)

The article describes the Magnacard and its associated processing equipment as developed by the Magnavox Corporation of Fort Wayne, Indiana. The basic element of the Magnacard system is a 1″ x 3″ ferromagnetic card capable of storing up to 600 alphanumeric characters or 1000 numeric characters. The processing equipment is capable of handling these cards at speeds comparable to magnetic tape handling speeds (i.e. 100 cards per second) and also has the ability to mechanically sort and select these discrete records. The specific pieces of equipment described are: (1) The Transcriber which produces the Magnacard either from keyboard, paper tape, or other source. (2) The Collator which mechanically performs merging-sorting-selecting operations on up to five trays (3000 cards per tray) of magnacards. (3) The File Block which is an automatically positioned set of magnacard trays (120 trays) which allows the automatic feeding of trays to collator. (4) The Interrogation File which permits the rapid search (5 seconds) of some designated subgroup of cards within the specific tray.

The author describes how these machines and their operations can be utilized in data processing problems and how computers and printers can be included as part of an overall system.

Bruce W. Arden, Ann Arbor, Mich.

93:

Proebster, W. E. **Dünne magnetische Schichten als Speichen- und Schaltkreiselemente** (Thin magnetic films as memory and switching elements). *Elektronische Rechenanlagen*, **4** (November 1959), 164–171. (German)

The author gives a very careful review of the work done since 1952 on Permalloy films, particularly as regards those properties directly related to application as computer memory elements. The static and dynamic properties of a single domain film describable by means of a uniaxial magnetic anisotropy energy $E_k = K \sin^2 \theta$ are reviewed, both from the point of view of theory and experiment. It is pointed out that the requirements of binary storage and fast switching ($\sim 10^{-9}$ sec.) are satisfied with such films. Deviations from the single domain theory in the form of wall switching and incoherent rotation are pointed out.

A discussion of the actual use of films in a memory is given along with a practical configuration. Brief mention of the possible use of films as logic elements is given, although discussion of the attendant difficulties is omitted.

An excellent bibliography of the work on Permalloy films is included.

Donald O. Smith, Lexington, Mass.

94:

Luhn, H. P. **Keyword-in-context index for technical literature.** *IBM ASDD Report* (August 1959), 1–15.

A method is described for preparing a form of subject index based on titles of articles. The following procedures are followed: (1) Titles of articles (excluding insignificant words) are key punched, together with bibliographic references, and authors (to the limit of capacity of the unit record used). This information is transferred to a tape-operated digital computer. (2) Each "key" word of each title is identified as an "index entry" and a listing is prepared which displays each entry in a fixed field, in alphabetical order, with the remaining words of the title appropriately shifted in position so that the entry is recorded in the pre-selected position.

The method has been suggested as a rapid and suitable device for disseminating new information.

This reviewer conducted, in 1952, experiments similar in philosophy to those proposed in this paper. The results were completely discouraging in all fields except for a narrow segment of medicine. An analysis of the results indicated that the discouraging results were caused by the loose choice of titles of articles by their authors. This mirrored very inexactly and at too general a level those contents of the articles which were of interest to persons desiring information from them.

It is interesting to note that, despite the apparent low effectiveness of the KWIC index, two professional organizations are seriously considering or promoting its use (*Chemical Abstracts Service* of the American Chemical Society, and the American Institute of Physics).

Allen Kent, Cleveland, Ohio

INFORMATION THEORY AND COMPUTERS

95:

MacDonald, J. E. **Design methods for maximum minimum-distance error-correcting codes.** *IBM J. Res. Develop.*, **4,** 1 (January 1960), 43–57.

This paper first compares the two upper bounds on the minimum distance of error-correcting codes due to Hamming and Plotkin. Codes are then classified into 16 types along with methods for the construction of the corresponding minimum distance codes. The codes produced cover those of Hamming, Plotkin, Slepian, and the Reed-Muller codes.

R. W. Hamming, Murray Hill, N. J.

96:

Melas, C. M. **A new group of codes for correction of dependent errors in data transmission.** *IBM J. Res. Develop.*, **4,** 1 (January 1960) 58–65.

Multiple related errors of any configuration can be automatically corrected by a class of codes having the property of using two groups of parity bits, one defining the error pattern, the other determining the location of the errors within the block.

In particular, error bursts can be corrected with a minimum amount of redundancy. Because each parity-bit group is derived by using maximum-length shift-register sequences, rather than by storing a decoding table, the implementation of these codes is relatively simple, as shown in an example of a three-bit-wide burst-correcting code. An example is given of an application of these codes in a data transmission system where only an even number of bits is likely to be corrupted by a noise burst.

(*From the Abstract*)

R. W. Hamming, Murray Hill, N. J.

LOGICAL DESIGN

97:

• Freudenthal, H. **Logique mathématique appliquée** (Logical mathematics applied). *Collection de Logique Mathematique*, Series A, **14,** Gauthier-Villars, Paris, 1958. 57 pp. $3.00. (French)

Math. Comput., **14** (April 1960), Rev. 40.

98:

• Culbertson, James T. **Mathematics and logic for digital devices.** D. van Nostrand Co., New Jersey, 1959. 224 pp. $4.85.

Math. Comput., **14** (January 1960), Rev. 26.

99:

• Gardner, Martin. **Logic machines and diagrams.** McGraw-Hill, Inc., New York, 1958. 157 pp. $5.00.

Math. Comput., **14** (January 1960), Rev. 28.

100:

Sprinivasan, C. V.; and Narasimhan, R. **On the synthesis of finite sequential machines.** *Proc. Indian Acad. Sci., Sect. A*, **50** (1959), 68–82.

This paper clearly and explicitly describes a procedure intended for use in arriving at a minimal state-diagram description of a synchronous sequential machine. The machine is assumed to be originally specified in terms of what outputs it will give after input sequences of length $\leq N$, starting in a given initial state S_0. The original specifications are also assumed to give certain end-conditions which permit deductions about the machine's behavior after sequences of length $>N$. The procedure is a reformulation of a method used by Mealy [*Bell System Tech. J.*, **34** (1955), 1045–1079; *Math. Reviews*, **17,** p. 436], with a discussion of modifications in the procedure due to certain possible changes in the manner of specifying such ma-

chines. The treatment of don't-care conditions makes an assumption (implicit in many other current papers on the subject) which Ginsburg [*J. Assoc. Comput. Mach.*, **6** (1959), 259–282] has shown sometimes prevents obtaining a minimal solution.

Edward F. Moore, Murray Hill, N. J.
(Courtesy, *Mathematical Reviews*)

MANAGERIAL APPLICATIONS

101:

• Arrow, Kenneth J.; Karlin, Samuel; and Scarf, Herbert. **Studies in the Mathematical theory of inventory and production.** Stanford University Press, Stanford, Calif., 1958. 340 pp. $8.75.

Math. Comput., **14** (January 1960), Rev. 21.

MECHANICAL LANGUAGE TRANSLATION

102:

Solomonoff, R. J. **A progress report on machines to learn to translate languages and retrieve information.** ZATOR Company, ZTB-134 (October 1959). 17 pp.

In the course of his investigations into inductive inference making machines, the author has set himself two specific problems: (1) to program a machine to learn to translate between languages, after having been presented with a large set of correct sample translations, and (2) to assign indexes to documents, after similar training. Both problems are intriguing, but little is shown to justify the author's claim of having made promising progress in their solution. What he actually does is either to impose such heavy restrictions on the conditions of applying his methods as to make any extrapolation extremely doubtful, or to "reduce" the problems to others that should be preliminarily solved. However, these problems show no sign of being in any sense simpler than the original ones. The author's notions of approximation and stochastic languages sound interesting, but far too little is said to allow for any serious evaluation of the claim that by their use the author's original problems have come any nearer to their solution.

The reviewer regards as especially unconvincing the author's claim that a unified method has been developed by him for resolving the difficulties of both the information retrieval and the mechanical translation routines.

Yehoshua Bar-Hillel, Jerusalem, Israel

NON-NUMERIC APPLICATIONS

103:

White, Gerald M. **Penny matching machines.** *Information and Control*, **2,** 4 (December 1959), 349–363.

This paper considers some strategies for machines which play the game of matching pennies. A first strategy, for a machine to use against an opponent who always plays heads with some fixed probability $P(h)$, estimates $P(h)$ as quickly as possible under the assumptions made about its distribution. A second strategy is also considered for a machine to use against a "Markov opponent" whose behavior is governed by a probability $P_h(h)$ of playing heads, if he had just previously played heads, and by another probability $P_t(h)$ of playing heads if he had just previously played tails. If the opponent is actually a Markov opponent, this paper notes that for certain values of $P_t(h)$ and $P_h(h)$ the first strategy does not do as well as the second strategy. The possibility of generalizing such results to machines performing more complicated game-playing or decision-making actions is mentioned several times.

Edward F. Moore, Murray Hill, N. J.

104:

Gruenberger, Fred. **An experiment in chess playing by machine.** *Computing News*, **8,** 2 (January 15, 1960), 3–7.

While this short note is not world-shaking and will hardly appeal to a chess master, it may be of interest to the growing number of ACM members who are involved in developing list-processing languages or in programming computers to play games. The author gives a humorous description of a chess game which he played against the Newell, Shaw, Simon, and Kanter chess-playing routine on the JOHNNIAC.

Fred "played like chess in his own unorthodox way" and, after finding himself behind in pieces, "learned faster than the machine" and won the game.

Arthur L. Samuel, Poughkeepsie, N. Y.

NUMERICAL MATHEMATICS

105:

Wetterling, W. **Zum Einschliessungssatz von Kryloff-Bogoliubov für allgemeine Eigenwertaufgaben bei gewöhnlichen Differential-gleichungen** (On the enclosure theorem of Kryloff and Bogoliubov for the homogenous characteristic values problem in ordinary differential equations). *Numerische Mathematik*, **2,** 1 (January 1960), 18–21. (German)

Let

$$M[y] = \sum_{\nu=0}^{m} [f_\nu(x) y^{(\nu)}(x)]^{(\nu)},$$

$$N[y] = \sum_{\nu=0}^{n} [g_\nu(x) y^{(\nu)}(x)]^{(\nu)}, \qquad n < m,$$

$$\int_a^b (uM[v] - vM[u])\,dx = \int_a^b (uN[v] - vN[u])\,dx = 0,$$

$$\int_a^b uM[u]\,dx > 0 \quad \text{for} \quad u \not\equiv 0.$$

Then for the homogeneous eigenvalue problem

$$M[y] = \lambda N[y],$$

if u_0, u_1 and u_2 satisfy

$$M[u_k] - tN[u_k] = N[u_{k-1}],$$

and there is no eigenvalue on the interval from 0 to t, there is at least one on the interval between

$$t + a_2/a_3 \pm [a_1/a_3 - (a_2/a_3)^2]^{\frac{1}{2}},$$

where

$$a_1 = \int_a^b u_1 N[u_0]\, dx,$$

$$a_2 = \int_a^b u_1 N[u_1]\, dx = \int_a^b u_2 N[u_0]\, dx,$$

$$a_3 = \int_a^b u_1 N[u_2]\, dx.$$

A. S. Householder, Oak Ridge, Tenn.

106:

Juncosa, M. L.; and Mullikin, T. W. **On the increase of convergence rates of relaxation procedures for elliptic partial difference equations.** *J. Assoc. Comput. Mach.*, **7,** 1 (January 1960), 29–36.

It has been observed that point relaxation methods applied to Neumann and mixed boundary value problems sometimes converge very slowly, especially in the case of irregular boundaries, where the distance between a boundary point and an interior lattice point is quite small compared to distances between adjacent interior lattice points. The purpose of this paper is to describe and, to some extent, to justify a partial solution to this problem which has been incorporated into the SPADE program. It consists in using the equations which are analogous to boundary and interface conditions to eliminate the unknown functional values at boundary and interface points from the equations to be subjected to the relaxation process. Then the relaxation is carried out only on the linear partial difference equation analogs of the partial differential equations defined in the interior of the region of interest and not on the difference equations analogous to normal derivative conditions, etc. It is proved that this scheme does not reduce the rate of convergence if the Gauss-Seidel process is used. In fact, the convergence is speeded up if the matrix is symmetric. The proof is an application of the Perron-Frobenius theory of non-negative matrices. Unfortunately, the eliminating process being described in this paper can destroy both symmetry and "property A," so that the theorems of Young and Kahan are ruled out. It is hoped, nevertheless, that the elimination process will not slow down overrelaxation procedures, but the question here has not yet been settled.

W. Robert Mann, Chapel Hill, N. C.

107:

Anderson, W. H.; Ball, R. B.; and Voss, J. R. **A numerical method for solving control differential equations on digital computers.** *J. Assoc. Comput. Mach.*, **7,** 1 (January 1960), 61–68.

Frequently, as in missile control systems, linear differential equations are simultaneous with nonlinear but slower acting differential equations. The numerical solution of this type of system on a digital computer is significantly speeded up by approximating the forcing functions with polynomials, solving the linear equations exactly, and numerically integrating the nonlinear equations with Milne integration. Automatic interval adjustment is possible by comparing errors in the nonlinear integration. The interval selected is related to the shortest time constant of the nonlinear equations rather than the shortest of all the equations. With this system, both detailed transient response and steady state conditions are revealed with a minimum of machine time. (*Author's Abstract*)

Bernard A. Galler, Ann Arbor, Mich.

108:

• Hofmann, J. E. **Classical Mathematics.** (Trans. by H. O. Midonick), Philosophical Library, 1959. 159 pp. $4.75.

This volume follows the *History of Mathematics*, and covers roughly the 17th and 18th centuries when modern mathematics was started. For one who knows the mathematics being discussed, it is a good, fairly concise history of the period so far as mathematics is concerned. The personal lives of the mathematicians, the social background in which they worked, and much of the philosophical framework are of necessity generally ignored or treated lightly in such a short book. Thus, the book is mainly "who did what when." In the famous priority question of the discovery of the calculus, the author gives the credit exclusively to Leibniz, which runs counter to most modern opinions. *R. W. Hamming*, Murray Hill, N. J.

109:

• Gantmacher, F. R. **Applications of the Theory of Matrices.** (Translated from the Russian by J. L. Brenner, A. W. Fushaw, and S. Evanusa), New York Interscience Publishers, Inc. 317 pp. $9.00.

This is a translation of the second half of the author's *Theory of Matrices*, which was published as a single volume in 1954 in Russian. This translation has appeared almost simultaneously with a two-volume translation of both parts, already reviewed in the *Journal of the ACM*. For an appraisal of the contents, the reader is referred to that review.

The duplication of effort is unfortunate, for valuable as the book is, two translations are hardly necessary. As translations, either is adequate, and both are well done. The preface to the present translation states that the first

part contains only material that is already "easily available," although some explanatory footnotes are added, as well as appendices (seven pages) with derivations of some standard theorems. The author has simplified things by attempting to make each chapter relatively selfcontained, as he states in his own preface.

Hirsch, in his translation, extends Gantmacher's valuable bibliography and brings it up to date, with 396 items listed. Unfortunately, there are a few careless errors in the list. The present translation adds a few items, but omits many, with a total of 72. Brenner's own papers on bounds for the roots are listed by Hirsch but not listed here, and of Brauer's papers on the same subject, only the fourth is listed here. On the other hand, there is added a reference to an obscure paper by Vyshnegradskiĭ (spelled Wischnegradski in the paper) in the *Comptes Rendus* for 1876.

Mention may be made in passing of the term "matrizant" which Gantmacher took over from the English (used by Frazer, Duncan, and Collar and attributed to Baker) phonetically as "matritsant." Hirsch returns this to English as "matricant," the present translators as "matrizer."

The translation is good, and reads as good English on the whole. Usually the notation is that of the original, but not everywhere; and some misprints in the original are corrected, but not all. Thus on page 83, a reversed inequality remains. Vectors are generally column vectors, but on page 68 one finds "$y = (y_1, y_2, \cdots, y_n)$," whereas elsewhere a prime is used to designate the transpose of the displayed vector. There is use of "respectively" in a way that is good German but not idiomatic English. These are details. Whether in the original or in translation, the book is worth having.

R. W. Hamming, Murray Hill, N. J.

110:

Chow, Tse-Sun; and Milnes, Harold W. **Boundary contraction solution of Laplace's differential equation II.** *J. Assoc. Comput. Mach.*, **7**, 1 (January 1960), 37–45.

In an earlier paper [*J. Assoc. Comput. Mach.*, **6** (1959), 226–235] Milnes and Potts introduced a method of deriving a numerical solution of a boundary value problem by successively contracting the boundary contour. The method was shown to be stable in the case of the Dirichlet problem for Laplace's equation on the circle. This paper is an analysis of the method as applied to the example with the circle. Sufficient conditions are established for the convergence of the sequence of approximates obtained by this method to the solution represented by Poisson's integral. Also, an estimate is given for the error in the approximation at each step.

R. C. F. Bartels, Ann Arbor, Mich.

111:

Coveyou, R. R. **Serial correlation in the generation of pseudo-random numbers.** *J. Assoc. Comput. Mach.*, **7**, 1 (January 1960), 72–74.

The author considers a generalized multiplicative congruential procedure of generating pseudo-random numbers. The basic recursion formula is

$$x_{n+1} \equiv \lambda x_n + \mu \pmod{P}$$

It is shown that the serial correlation between x_n and x_{n+1} has the form

$$[P^2 - 6\mu\,(P - \mu)]/P^2\lambda.$$

An extension to arbitrary lags between numbers in the sequence is also provided. An implication not explicitly given is that two different sequences of pseudo-random numbers, each of which contain the same set of elements, do not necessarily have the same serial correlation. It is desirable for most applications that λ be chosen as large as possible. A misprint appears in the numerator of the first fraction of the second integral on page 74. It should read "$\lambda x + \mu$" instead of "$2x + \mu$".

Jack Moshman, Alexandria, Va.

112:

Langdon, Lyle R. **Approximating functions for digital computers.** Reprinted from *Industrial Mathematics*, **6** (1955), 79–100.

Math. Comput., **14** (April 1960), Rev. 39.

113:

• Lowan, A. N. **The operator approach to problems of stability and convergence of solutions of difference equations and the convergence of various iteration procedures.** Scripta Mathematica, New York, 1957. 104 pp. $3.00.

Math. Comput., **14** (January 1960), Rev. 5.

114:

Hershey, A. V. **Computing programs for the complex exponential integral.** NAVORD Report No. 5909, NPG Report No. 1946, U. S. Naval Proving Ground, Dahlgren, Va. Astia Document Service Center, Armed Services Technical Information Agency, Arlington Hall Station, Arlington 12, Va. 16 pp.

Math. Comput., **14** (January 1960), Rev. 6.

115:

• Kantorovich, L. V.; and Krylov, V. I. **Approximate methods of higher analysis.** Translated from the 3rd Russian edition by C. D. Benster. Interscience Publishers, Inc., New York, 1958. 681 pp. $17.00.

Math. Comput., **14** (January 1960), Rev. 24.

116:

• **Handbook of chemistry and physics,** 41st edition (1959–60); and **CRC standard mathematical tables,** 12th edition (1959), Chemical Rubber Publishing Co., Cleveland, Ohio. 525 pp.

These tables continue their tradition of excellence; the separately bound Mathematical Tables being pretty much

the same as those in the Handbook except for containing additional tables of: $\sin^2 x$, $\sin x \cos x$, $\cos^2 x$; 14,000 random decimal digits; more on Bessel functions; graphs of selected Fourier expansions; various curves and surfaces; some 60 pages of interest tables; plus several miscellaneous items. Each issue sees the addition of new material in the mathematical tables which make it more valuable to the occasional user and, being the result of many years of such growth, they are perhaps the most widely used.

R. W. Hamming, Murray Hill, N. J.

SCIENTIFIC AND ENGINEERING APPLICATIONS

117:

Tsukernik, L. V.; and Kachanova, N. A. **Analysis of the static stability of complex power systems with the aid of electronic computers.** *Elektrichestvo*, 7 (1957), 39–45. (Russian)

(Courtesy *LLU Translations Bulletin*, August, 1959)
[Lending Library Unit, London, England]

118:

Vine, J. **Application of a combination of analogue and digital computers to electron trajectory tracing.** *The Computer Journal*, **2**, 3 (October 1959), 134–143.

The motion of electrons through axially symmetric electrostatic fields can be expressed in terms of ordinary differential equations involving terms depending on the potential distribution. Under certain assumptions, these equations can be solved on a digital computer to find the paraxial solution and to determine aberrations. The equations are more complicated for the tracing of rays which make large angles with the axis, involve the complete two-dimensional potential distribution, and require the determination at each time-step of two coordinates of position and velocity. In all cases, the electrostatic potential is measured by means of a resistance network.

Equations and methods are given in detail, together with a flow-diagram for the harder problem. Results obtained from a Pegasus computer are compared with known solutions for particular examples, indicating an accuracy of about 0.1 per cent in the predicted electron positions.

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119:

Kachanova, N. A.; and Umed'yan, V. V. **Programming the computations for an economic load-distribution in the power-system by digital computers.** *Elektrichestvo*, **9** (1959), 1–5. (Russian)

The paper under review deals with the method of computing an economical effective-load-distribution among caloric power-stations with digital computers (the computation of the short-dated utilization of power-supply-networks with hydroelectric stations can also be carried out by this method). The hourly consumption of a conventional fuel in the entire network was assumed to be a criterion for the economical distribution (Refs 1, 2). The computing method does not vary, when the minimum net-cost of the electric energy (Ref 3) is assumed as a criterion, or the distribution of the effective load among the power-stations of the system at predetermined fuel consumption (Ref 2) is considered. By assuming the usual simplifications, it is now the task to determine that effective-load distribution, at which the lowest hourly consumption of a conventional fuel in the entire network is obtained, by solving the system of the equations (1) and (2), (Ref 1). For the consideration of the losses in the network, the method of coefficient-determination is applied here. The equation (3) for the total losses in the network is written down. The distribution-coefficients α are calculated only once for the network under consideration. They are calculated easily on a model of the network, or analytically. The calculation of the coefficients β, equation (4), is made by an electronic digital computer. The functions $\epsilon_i = f(P_i)$ cannot be expressed analytically. The solution of (1) and (2) is therefore very difficult. ϵ_i is the relative increase in the consumption of the conventional fuel of the ith power-station. P_i is the unknown actual efficiency of the ith power-station. For simplification, the $\epsilon = f(P)$-curve is approximated by a polygonal curve. In order to prevent an ambiguous solution, ϵ is not assumed to be a function of P, but vice versa $P = \varphi(\epsilon)$, equation (6). The equation (7) is therefore the equation for each section of the polygonal curve. The equation (9) for ϵ_i is derived and is solved together with (7) by the method of successive approximation. In order to find out the economical effective-load-distribution among the power-stations, the equations (9) and (7) are solved for different values of μ, equation (8). The distribution of the effective loads can be found if the loads of the equation (2) suffice. The logical diagram for the solution of the equations (9), (7) and (2) on electronic digital computers is shown in figure 1. Since the same values of the coefficients β can be used for a series of calculations, a special program is made for their calculation. After all β have been calculated, the program for the calculation of the economical load-distribution is inserted into the electronic digital computer (Fig 1). The sequence of the calculations is shown. The logical diagram shown in figure 1 may be applied to special-, as well as universal-computing machines. The solution of such a task for a network of 5 power-stations, 10 sub-stations and 10 branches takes 3 minutes on the "Ural" computer, not including the insertion of the data, command-giving and printing of the results. The paper under review was composed under the direction of L. V. Tsukernik at the Laboratoriya elektrostantsiy i energosistem Instituta elektrotekhniki AN USSR (Laboratory for Power-stations and Power-networks of the Institute of Electrical Engineering of the AS UkrSSR). There are 2 figures and 5 Soviet references.

(*Translated from the Abstract*)

120:

Keropyan, K. K. **Design of plane single-stage frames having free nodes by means of electrical analogues.** *Izvestiya Vysshikh Uchebnykh Zavedeniy,* Elektromekhanika, **1959,** 6, 17–24. (Russian)

The methods of electrical analoguing of various engineering structures have been successfully employed in the Soviet Union and abroad (Refs 1–6, 8). The first successful method was devised by V. I. Usynin (Ref 5). The author employed the iteration method in conjunction with electrical analogues and found it possible to design a framework having free nodes. The unknown displacements δ of the nodes of each stage were initially assumed to be arbitrary and the resulting deflection angles of the supporting beams were introduced into the analogue in the form of e.m.f.s. Deflection δ' was then obtained, the e.m.f.'s were readjusted and a new deflection δ'' was obtained. After about ten iterations, a correct value of δ is obtained. This method is disadvantageous in that it entails a large number of calculations. The equations for a node C of a framework can be written as Eq (1) (see Ref 7, p. 361), where φ and δ are the unknown deflection angles and linear displacements, respectively. The symbol m in the equation denotes the ends of the beams, which are rigidly fixed to the frame, while p denotes the hinged ends. Further equations for the system are in the form of Eq (2), where m denotes the number of vertical beams which are rigidly fixed at both ends, k is the number of the vertical rods which are hinged at the upper end and p is the number of the vertical rods having hinges at the lower ends. On the basis of Eqs (2), the expression for δ is given by Eq (3), where A is defined by the first equation on p. 19. It is possible to design a framework by employing the well-known Cross method in conjunction with a suitable electrical analogue. As an illustration, a single-stage framework is shown in Figure 1 and its equivalent circuit is given in Figure 2a. On the basis of the Cross method, the node moments are first determined under the assumption that the framework cannot be displaced vertically. The displacement corrections are then introduced and the final moments are evaluated. The design is effected in two stages. Consequently, a two-stage analogue design is also used. First, it is assumed that the system cannot be displaced vertically and an electrical analogue is constructed (Figure 2a). By measuring the voltages across the resistances r_{12} and r_{21} of each three-terminal network representing one of the vertical beams, the reaction R_{1p} is evaluated by employing Eq (3) and assuming that $\delta = 0$. The reaction R_{1p} does not really exist since the frame undergoes a displacement δ_0 such that the reaction becomes zero. The displacement can be determined if it is assumed that the horizontal beam (Figure 1) undergoes a displacement $\delta = 1$. The deflection angles can now be evaluated and a new analogue (Figure 2b) is constructed. The voltages at the terminals of the analogue are measured and a new value of the reaction is determined. It is now possible to construct a graph showing the dependence of the displacement δ on the reaction R_{1p} (Figure 3). The value of δ_0 is now easily obtained from the graph. The accurate values of the deflection angles can now be calculated and a new analogue can be devised from which the final values of the moments are found. The method was employed to carry out the design for the framework of Figure 1. The results are given in Tables 1–3. It was found that the discrepancies between theoretical and the measured results were of the order of 5%. There are 3 figures, 3 tables and 8 references, of which 1 is English and 7 are Soviet.

(*Translated from the Abstract*)

121:

Simkin, M. M. **Application of digital computer techniques to systems of automatic control and regulation.** *Avtomat. i Telemekh,* **2** (1956), 180–190. (Russian)

(Courtesy *LLU Translations Bulletin,* August, 1959)

122:

Computers in behavioral science. *Behavioral Science,* **4,** 3 (July 1959), 248–257.

Summary:

Uhr, Leonard. *Latest methods for the conception and education of intelligent machines.* This is a report on the 1959 Western Joint Computer Conference held in San Francisco, California March 3–5 under the joint sponsorship of IRE, ACM and AIEE. The theme of the meeting was "New Horizons in Computer Technology."

The following recent papers on new ideas for computer application are described:

Highleyman, W. H., Kamentsky, L. A.; and Heasley, C. C. *Pattern recognition (perception) machines.*

Kessel, B., DeLucia, A.; Doyle, L.; de la Braiandais, R.; and Walker, C. *Information retrieval and language translation machines.*

Greene, P. H.; Campaigne, H.; and Bouricius, W. G. *Problem solving and learning machines.*

The following articles and abstracts also appear in the same section:

Dickman, Kern W. *Index of statistical programs available in the statistical library of the ILLIAC (Part 1).*

Baker, Frank B. *Univac scientific computer program for test scoring and item analysis.*

Uhr, Leonard. *A general intercorrelation program for the minimal IBM 650.*

Anderson, Betty L.; and Lawton, T. J. *COFIT, a least squares cosine fitting program for the IBM 704.*

Hobby, Charles; Newhouse, Albert; and Giezl, Louis. *An integrated set of programs for the minimal IBM 650 for curve and surface fitting on unequally spaced points.*

The Editors

123:

Calculo Automatico y Cibernetica (Automatic Calculators and Cybernetics), **8,** 20 (July 1959). 94 pp.

This journal, under directorship of A. Gonzalez del Valle, is published by the Spanish Society of Cybernetics in Madrid. In brief summary, this issue contains four

principle articles, three in Spanish and one in French. Translated, they are as follows: A. Boniforti, *Counter of four decades with predetermination* (on industrial process control); A. Gonzalez del Valle, *Geometry of electrical networks. General methods of the representation of points and their applications to automatic calculation; Characteristics of the Univac U.C.T. system;* and, *The automatic calculator in the networks of distribution of energy by I.B.M. electronic calculators.*

Two-thirds of the journal is devoted to a bulletin of documentary information and bibliography, a general index of articles by title, and a book review section. The articles have been assigned to reviewers for the August issue.

The Editors

TECHNOLOGICAL EFFECTS OF COMPUTERS, AND CYBERNETICS

124:

Brewer, R. C. **The automatic control of production processes.** *Cybernetica*, **2,** 2 (1959), 92–108.

This paper discusses briefly the development of machines such as automatic screw machines, which merely mechanize manual functions, and then goes on to discuss more advanced approaches in which some simulation of the functions of the human brain is achieved.

As the author states, "the object of the present paper has been to indicate rather broadly what has been achieved so far; in particular, it is hoped that attention has been drawn to the difference between mechanization and automation, i.e. the simulation of purely manual techniques as against the simulation of mental processes in addition to manual techniques."

William W. Seifert, Cambridge, Mass.